Chromium Electroplating & Anodizing MACT Training 40 CFR Part 63.340

Melissa Woolf
8/27/03

Agenda

- Pretest
- Process & Tank Size
- Applicability
- Compliance Deadlines
- Decorative Plating Tanks Using Trivalent
- Emission Limits
- Work Practice Standards
- Initial Testing
- Ongoing Monitoring
- Recordkeeping
- Reporting
- Proposed Changes to Subpart N
- NE Sources
- Permitting
- Inspections
- Post Test

Process

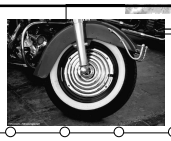
- Chromic Acid Electroplating
  - Hexavalent chromium
  - Most widely used
  - 80-90% of electrical current applied is consumed by evolution of oxygen and hydrogen gases at the electrodes
  - As bubble bursts at surface of electroplating solution, fine mist is formed
  - Rate of mist is function of chemical or electrochemical activity and increases with amperage and parts plated

Process

- Trivalent Chromium Electroplating
  - Used at less than 10% of facilities
  - Single-cell
    - Halogen-based system using graphite anodes and additives to prevent oxidation
    - Anodes are in direct contact with the solution
  - Double cell
    - Sulfate-based system in which lead anodes are encased in boxes lined with permeable membrane and contain a dilute solution of sulfuric acid
    - Requires fewer additives and eliminates contact and oxidation of electrolyte at the anode

Process

- Chromium Anodizing
  - Voltage controlled process applied in 5 volt increments
  - When current is applied, chromic acid breaks down and releases oxygen and hydrogen
  - Oxygen evolves at aluminum part creating aluminum oxide layer
  - Chromic and dichromic acids in bath react with aluminum oxide film and results in fine pores that enhance continuation of current flow to metal
  - Most chromic acid mist at beginning of process



Process

- Hard Chromium Electroplating
  - Thick layer of chromium for wear and corrosion resistance, low friction, and hardness
- Decorative Chromium Electroplating
  - Thin layer on base for bright finish with wear-and-tarnish resistance (bicycles, auto trim, tools etc.)
  - May use chromic acid or trivalent chromium
- Chromium Anodizing
  - Chromium oxide layer on aluminum for corrosion resistance (aircraft parts, architectural structures etc.)

Tanks

- Small vs. large source
  - Determined by rectifier capacity
  - Maximum cumulative potential rectifier capacity
    - Sum of all hard chrome tank capacities
    - Sum * 8400 hr/yr. * 0.7 = amp-hr/year
  - Small < 60 million amp-hr/year
  - Large ≥ 60 million amp-hr/year

Applicability

- All sources that operate chromium electroplating or anodizing tanks
  - Regardless of size
- Existing source
  - Constructed or reconstructed prior to 12/16/93
- New source
  - Constructed or reconstructed on or after 12/16/93

Applicability

- Exemptions
  - Process tanks in which neither electroplating nor anodizing is taking place.
  - Tanks that contain chromium solution, but in which no electrolytic process occurs.
  - Research and laboratory operations.

Compliance Deadlines

- Existing
  - Decorative chromium electroplating operations
    - 1/25/96
  - Hard chromium electroplating and anodizing operations
    - 1/25/97
- New and Reconstructed Sources
  - Initial startup after 1/25/95 (promulgation date)
    - Immediately upon startup
  - Initial startup after 12/16/93 but before 1/25/95
    - 1/25/98

Compliance Deadlines

- Small hard chromium electroplating operations
  - Increase maximum cumulative potential, or actual, rectifier capacity to become large operation
    - Comply with the large hard chromium electroplating requirements within one year of the month they become large

Decorative Plating Tanks Using a Trivalent Chromium Bath

- Sources incorporating a wetting agent as a bath ingredient
  - Only subject to the recordkeeping and reporting requirements
- Recordkeeping
  - Must keep records of bath component purchases

Decorative Plating Tanks Using a Trivalent Chromium Bath

- Reporting
  - Initial notification report
    - 7/24/95
  - Notification of compliance status
    - 2/24/96
  - Notification of process change
    - Within 30 days of change

Decorative Plating Tanks Using a Trivalent Chromium Bath

- Sources not using wetting agent as a bath ingredient
  - Subject to the emission limits for decorative plating tanks using a chromic acid bath
  - Emission limits covered later

Emission Limits

Hard Chromium Plating

- Existing small tanks
  - **Emission Limit**
    - 0.03 milligrams per dry standard cubic meter (mg/dscm)
  - **Emission Reduction Technique**
    - Packed-bed scrubber (PBS)
- All new tanks and existing large tanks
  - **Emission Limit**
    - 0.015 milligrams per dry standard cubic meter (mg/dscm)
  - **Emission Reduction Technique**
    - Composite mesh-pad (CMP) system

Emission Limits

Decorative Chrome Plating Using Chromic Acid

- All Tanks
  - **Emission Limit**
    - 0.01 milligrams per dry standard cubic meter (mg/dscm)
  - **Emission Reduction Technique**
    - Fume suppressant (FS)

OR

  - **Emission Limit**
    - 45 dynes per centimeter (dynes/cm)
  - **Emission Reduction Technique**
    - Fume suppressant (FS) that contains a wetting agent

Emission Limits

Chromium Anodizing

- All tanks
  - Emission Limit
    - 0.01 mg/dscm
  - Emission Reduction Technique
    - Fume suppressant

or

  - Emission Limit
    - 45 dynes/cm
  - Emission Reduction Technique
    - Fume suppressant that contains a wetting agent

Work Practice Standards

- Prepare Operation and Maintenance (O & M) Plan
  - Developed and implemented by compliance date; and,
  - Kept onsite for the life of source
  - Contents
    - Site-specific criteria for source, add-on air pollution control device (if used), and monitoring equipment
    - Must include a standardized checklist to document the operation and maintenance;

Work Practice Standards

- O & M Plan
  - Contents
    - Plan must incorporate work practice standards for that air pollution control device and monitoring equipment;
    - If control equipment is used that is not identified in the standard, the plan must incorporate proposed work practice standards for that equipment;
    - Specify procedures to be followed to ensure that equipment or process malfunctions do not occur; and,
    - Specify a systematic procedure for identifying malfunctions of process equipment, add-on pollution control devices, and process and control system monitoring equipment, and, for implementing corrective actions to address malfunctions.

Work Practice Standards

- O & M Plan
  - Contents
    - If the plan fails to address or inadequately addresses a malfunction, it must be revised within 45 days.
    - Other existing plans, e.g., standard operating procedures (SOP) manuals, OSHA plans, etc., can be used provided they satisfy the requirements of the standard.
- Conduct quarterly inspections of control devices, ductwork, and monitoring equipment

Work Practice Standards

Composite mesh-pad (CMP) system

- Visually inspect device to ensure there is proper drainage, no chromic acid buildup on the pads, and, no evidence of chemical attack on structural integrity of the device
- Visually inspect the back portion of the mesh pad closest to the fan to ensure there is no breakthrough of chromic acid mist.

Continued

Work Practice Standards

Composite mesh-pad (CMP) system

- Visually inspect ductwork from tank or tanks to the control device to ensure there are no leaks
- Perform washdown of the composite mesh-pads in accordance with manufacturers recommendations

Work Practice Standards

Packed-bed Scrubber (PBS)

- Visually inspect the device to ensure there is proper drainage, no chromic acid buildup on the packed beds, and no evidence of chemical attack on the structural integrity of the device.
- Visually inspect the back portion of the chevron blade mist eliminator to ensure that it is dry and there is no breakthrough of chromic acid mist.

Continued

Work Practice Standards

Packed-bed Scrubber (PBS)

- Visually inspect ductwork from tank or tanks to the control device to ensure there are no leaks.
- Add fresh makeup water to the top of the packed bed.

Work Practice Standards
Combination PBS and CMP System

- Follow work practice standards for the composite mesh-pad system

Work Practice Standards
Fiber-bed mist eliminator

- Visually inspect fiber-bed unit and prefiltering device to ensure there is proper drainage, no chromic acid buildup in the units, and no evidence of chemical attack on the structural integrity of the devices.
- Visually inspect ductwork from tank or tanks to the control device to ensure there are no leaks.

Work Practice Standards
Fiber-bed mist eliminator

- Perform washdown of fiber elements in accordance with manufacturer
- The work practice standards for the control device installed upstream of the fiber-bed mist eliminator to prevent plugging do not apply as long as the work practice standards for the fiber-bed unit are followed.

Initial Testing

- An initial performance test must be conducted to:
  - Demonstrate compliance with the standard
  - Establish site-specific operating parameters
- Exempted sources:
  - Decorative and anodizing tanks using wetting agents and limiting the surface tension to 45 dynes/cm; and,
  - Decorative tanks that use a trivalent chrome bath and a wetting agent in the bath.

Initial Testing

- Test required by:
  - 7/23/96 for decorative chromium platers
  - 7/24/97 for hard chromium platers and chromium anodizers
  - New sources (began operation after initial testing dates above) - 180 days after startup
- Tests done prior to December 1991 are not acceptable

Initial Testing

- Site-specific Operating Parameters
  - Composite mesh-pad systems
    - Establish the pressure drop across the system that results in compliance with the emission limit
  - Packed-bed scrubber systems
    - Establish the pressure drop across the system and the velocity pressure at the common inlet of the control device that results in compliance with the emission limit

Initial Testing

- Site-specific Operating Parameters
  - Packed-bed scrubber/composite mesh-pad systems
    - Establish the pressure drop across the system that results in compliance with the emission limit
  - Fiber-bed mist eliminator
    - Establish the pressure drop across the fiber-bed mist eliminator and the pressure drop across the control device installed upstream of the fiber bed to prevent plugging that results in compliance with the emission limit

Initial Testing

- Site-specific Operating Parameters
  - Wetting agent-type or combination wetting agent-type foam blanket fume suppressant
    - Establish the surface tension of the bath, using Method 306B, that results in compliance with the emission limit
  - Foam blanket-type fume suppressant systems
    - Establish the minimum foam blanket thickness that results in compliance with the emission limit

Initial Testing

- Site-specific Operating Parameters
  - Fume suppressant and add-on devices
    - Establish operating parameters for both the fume suppressant and add-on devices that results in compliance with the emission limit.

Ongoing Monitoring

- Ongoing monitoring of site-specific operating parameters established during initial testing
- Sample monitoring checklists

Ongoing Monitoring

- Composite mesh-pad systems
  - Monitor the pressure drop across the system once per day
- Packed-bed scrubber systems
  - Monitor the pressure drop across the system and the velocity pressure at the common inlet of the control device once per day

Ongoing Monitoring

- Packed-bed scrubber/composite mesh-pad systems
  - Monitor the pressure drop across the system once per day
- Fiber-bed mist eliminator
  - Monitor the pressure drop across the fiber-bed mist eliminator and the pressure drop across the control device installed upstream of the fiber bed to prevent plugging once per day

Ongoing Monitoring

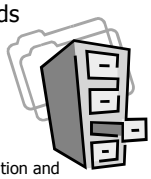
- Wetting agent-type or combination wetting agent-type foam blanket fume suppressant
  - Monitor the surface tension of the bath using Method 306B once every 4 hours
- Foam blanket-type fume suppressant Systems
  - Monitor the minimum foam blanket thickness once per hour

Ongoing Monitoring

- Fume suppressant and add-on devices
  - Monitor operating parameters for both the fume suppressant and add-on devices at their frequency.
- The monitoring frequency may be decreased for wetting agents and foam blanket emission reduction techniques if the emission limit is not exceeded in 40 hours of operation

Recordkeeping

- All records must be kept for 5 years
- Inspection and maintenance records
  - Show work practices done on schedule
  - Checklists adequate
  - Record all maintenance (contractor invoices)
- Malfunction records
  - Occurrence, duration and cause
  - If corrective action consistent with the operation and maintenance plan, do not keep record
  - If corrective action inconsistent with plan, must keep records.



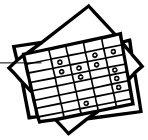
Recordkeeping

- Performance test results
  - Include operating parameters
- Monitoring data records
  - Record control device, parameters monitored, parameter values and time/date of monitoring
- Excess emissions records
  - When parameters outside of range - dates, start and end times

Recordkeeping

- Process records
  - For all electroplating and anodizing tanks, record process operating time
  - For tanks using fume suppressants, record date/time of each addition of fume suppressants
  - For small hard chrome operations, record the actual cumulative rectifier capacity expended each month and total capacity for reporting period
  - For decorative tanks using trivalent chrome bath with a wetting agent, record the bath component purchases with wetting agent clearly identified as a constituent/component (keep receipts)

Reporting



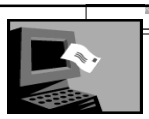
- Initial Notification
  - All tanks 7/24/95
- Notification of Construction or Reconstruction
  - As soon as practical before construction
  - Where applicable, can be used for initial notification
- Notification of Performance Test
  - At least 60 days before the test

Reporting

- Notification of Compliance Status
  - Decorative Tanks Using a Trivalent Chrome Bath and a Wetting Agent
    - 2/24/96
  - All other tanks
    - No more than 45 days after initial test or 2/24/97 if no test required
- Notification of Initial Test Results
  - No more than 45 days after the test
  - Submit with Compliance Status Report
- Notification of process change
  - No more that 30 days after the change

Reporting

- Ongoing Compliance status reports
  - Major sources
    - Twice per calendar year
    - Four time per calendar year if exceedances occur or if requested
    - Due within 30 days after end of reporting period
  - Area sources
    - Complete an annual summary report and maintain on site
    - Submit, twice per year if exceedances occur or if requested
    - Due within 30 days after end of reporting period



Reporting

- Area Source Ongoing Compliance Status Reports
  - The report shall be completed annually and kept on site, unless;
    - The total duration of excess emissions is 1 percent or greater of the total operating time for the reporting period, and,
    - The total duration of malfunctions of the add-on air pollution control device and monitoring equipment is 5 percent or greater of the total operating time.

Reporting

- Ongoing Compliance Status Reports – Excess Emissions
  - Frequency can be reduced from quarterly
    - Must document 1 full year of compliance with the standard;
    - The owner or operator continues to comply with the standard; and,
    - The Administrator does not object to a reduced frequency.

Proposed Changes

- Proposed 6/5/02
- Allow hard chromium tanks to implement one of two new alternatives to existing control requirements
  - Option #1 – Use fume suppressants to meet surface tension limit similar to decorative tanks
    - Different surface tension limits based on type of measurement performed (35 dynes/cm if using tensiometer, less restrictive than 45)
    - Would also apply to decorative tanks
  - Option #2 – Meet alternative mass emission rate instead of concentration standard
    - Only for enclosed tanks

Proposed Changes

- Changes definition of "tanks"
  - Tank replacements should be considered routine preventative maintenance
  - Definition would include ancillary equipment which would allow replacement
- Revise required operating limit for pressure drop across composite mesh pad control devices
  - Lots of sources couldn't comply with $\pm$1 inch pressure drop value when cleaned or replaced
  - Increased range would allow $\pm$ 2 inches

NE Sources

- Currently, 5 sources operating (outside OAQC & LLCHD)
  - 1 – Major source with hard, large chromium electroplating tanks
  - 1 – Synthetic minor source with hard, large chromium electroplating tanks
  - 1 – Area source with hard, small chromium electroplating tanks
  - 2 – Area sources with hard decorative chromium electroplating tanks
- 1 new source constructing
  - Minor source with hard, small chromium electroplating tanks

Permitting

- Decorative chromium electroplating or chromium anodizing operations that use fume suppressants
- Decorative chromium electroplating operation using a trivalent chromium bath that uses a wetting agent
  - Exempt from operating permit requirements if they are not a major source or located at a major source

Permitting

- All other operations subject to Subpart N are required to obtain a Class I operating permit
  - Sources that are not major or located at major sources are deferred until 12/9/04
  - Must submit permit applications by 12/9/05
- Florida – Title V General Permits

Inspections

- EPA requested area sources be inspected
- Use inspection checklists provided in MACT Notebook
- Compliance with pressure drop on composite mesh pads, EPA is not pursuing enforcement